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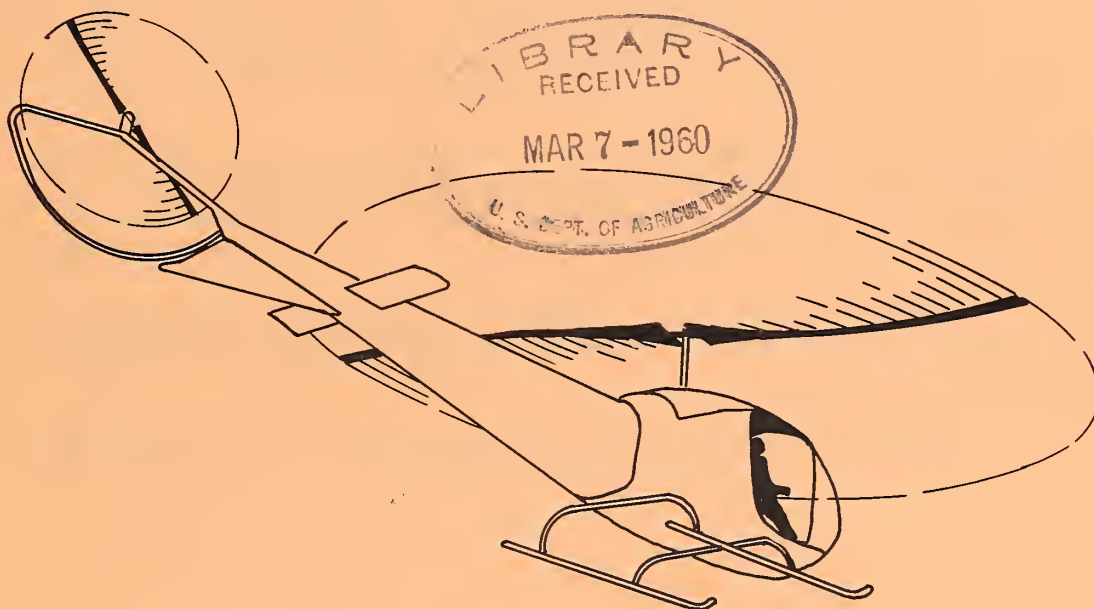
TECHNICAL EQUIPMENT REPORT NO. F-7
JULY 1959

HELICOPTER ACCESSORIES FOR FOREST FIRE CONTROL

(A PROGRESS REPORT)

by

MISSOULA EQUIPMENT DEVELOPMENT CENTER
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE
MISSOULA, MONTANA



FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

TECHNICAL EQUIPMENT REPORT NO. F-7

PROGRESS REPORT

HELICOPTER ACCESSORIES FOR FOREST FIRE CONTROL

By

Missoula Equipment Development Center
U. S. Department of Agriculture
Forest Service
Missoula, Montana

July 1959

Region One is making an administrative study of helicopter use for fire control in back-country areas. This program is set up on a two-year basis; the first year's operational period was from June 1 through September 16, 1958. Experimental operations were conducted in the Selway-Bitterroot Primitive Area and many possibilities of practical helicopter use were explored during the 1958 season.

This report is concerned with only one phase of the experiment--the development of helicopter equipment and accessories required for safe delivery of men and fire-fighting equipment to back-country areas.

Undoubtedly others engaged in forest fire control will be interested in the accessories developed during the helicopter study.

This study will continue through Fiscal Year 1960; further development work will be reported currently.



CONTENTS

Page Number

Photograph - Bell Helicopter Model 47G-2.	4
Drawing - Helicopter accessories for Bell Helicopter Model 47G-2	5
Photograph - Signal warning light	6
Drawing - Signal warning light.	7
Materials list - Signal warning light	8
Photograph - Safety step for helitack crew member, Bell 47G-2	9
Drawing - Safety step for helitack crew member, Bell 47G-2. .	10
Materials list - Safety step for Bell 47G-2	11
Photograph - Safety handrail for helitack crew member, Bell 47G-2.	12
Drawing and materials list - Safety handrails, Bell 47G-2 . .	13
Photograph - Cargo carrying shackle and support bracket, Bell 47G-2	14
Drawing - Cargo carrying shackle and support bracket, Bell 47G-2	15
Materials list - Cargo carrying shackle and support bracket, Bell 47G-2	16
Photographs - Bomb shackle, cargo sling and cargo net in use	18
Photograph - Cargo rack attached to skids, Bell 47G-2	21
Drawing - Cargo racks for Bell 47G-2	22
Materials list - Cargo racks for Bell 47G-2	23
Photographs - Cargo racks in use.	24
Photograph - Bell Ranger helicopter, Model J	25
Drawing - Helicopter accessories for Bell Ranger Model J. . .	26
Photograph - Cargo carrying shackle support bracket, Bell Model J	27

Drawing - Cargo carrying shackle for Bell Model J	28
Materials list - Cargo carrying shackle for Bell Model J. . .	29
Photograph - Safety handrails for helitack crew members, Bell Model J	31
Drawing - Handrail for Bell Model J	32
Photograph - Rear safety handrail and safety harness anchor for helitack crew members, Bell Model J	33
Drawing - Handrails for Bell Model J	34
Drawing - Safety harness anchor, Bell Model J	35
Materials list - Safety harness anchor, Bell Model J	36
Photograph - Safety harness for helitack crewman	37
Drawing - Safety harness for helitack crewman	38
Materials list - Safety harness for helitack crewman	39



BELL HELICOPTER MODEL 47G-2

SIGNAL LIGHT
SWITCH
ON REAR.

CARGO SHACKLE
RELEASE SWITCH
ON FRONT.

HAND RAIL ON
RIGHT HAND SIDE.
SEE DWG. NO.
ED-163-RI.

SAFETY HARNESS
SNAPPED TO SAFETY
BELT ANCHOR "V"
RING BETWEEN THE
SEATS. SEE DWG.
NO. ED-154-RI.

RIGHT HAND SIDE
DOOR IS REMOVED
& THIS SECTION OF
THE CABIN IS REMOVED
FOR EASIER HELIHOOPER
ACCESSABILITY.

HAND RAIL ON
CARGO RACK.
SEE DWG. NO.
ED-163-RI.

SIGNAL LIGHT
ON RIGHT HAND
SIDE. SEE DWG.
NO. ED-156-RI.

18" EXTENSION
ADDED FOR TAIL
ROTOR PROTECTION.

STEP,
SEE DWG.
NO. ED-155-RI.

CARGO CARRYING
SHACKLE. SEE
DWG. NO. ED-70-RI.

CARGO RACK
SEE DWG. NO.
ED-161-RI.

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

MISSOULA
EQUIPMENT
DEVELOPMENT CENTER

HELICOPTER ACCESSORIES
FOR

BELL HELICOPTER
MODEL 47G-2

DRAWN BY: A. R.F.

CHECKED BY: O. BR.

APPROVED: [Signature]

SCALE: 3/8" = 1'-0"

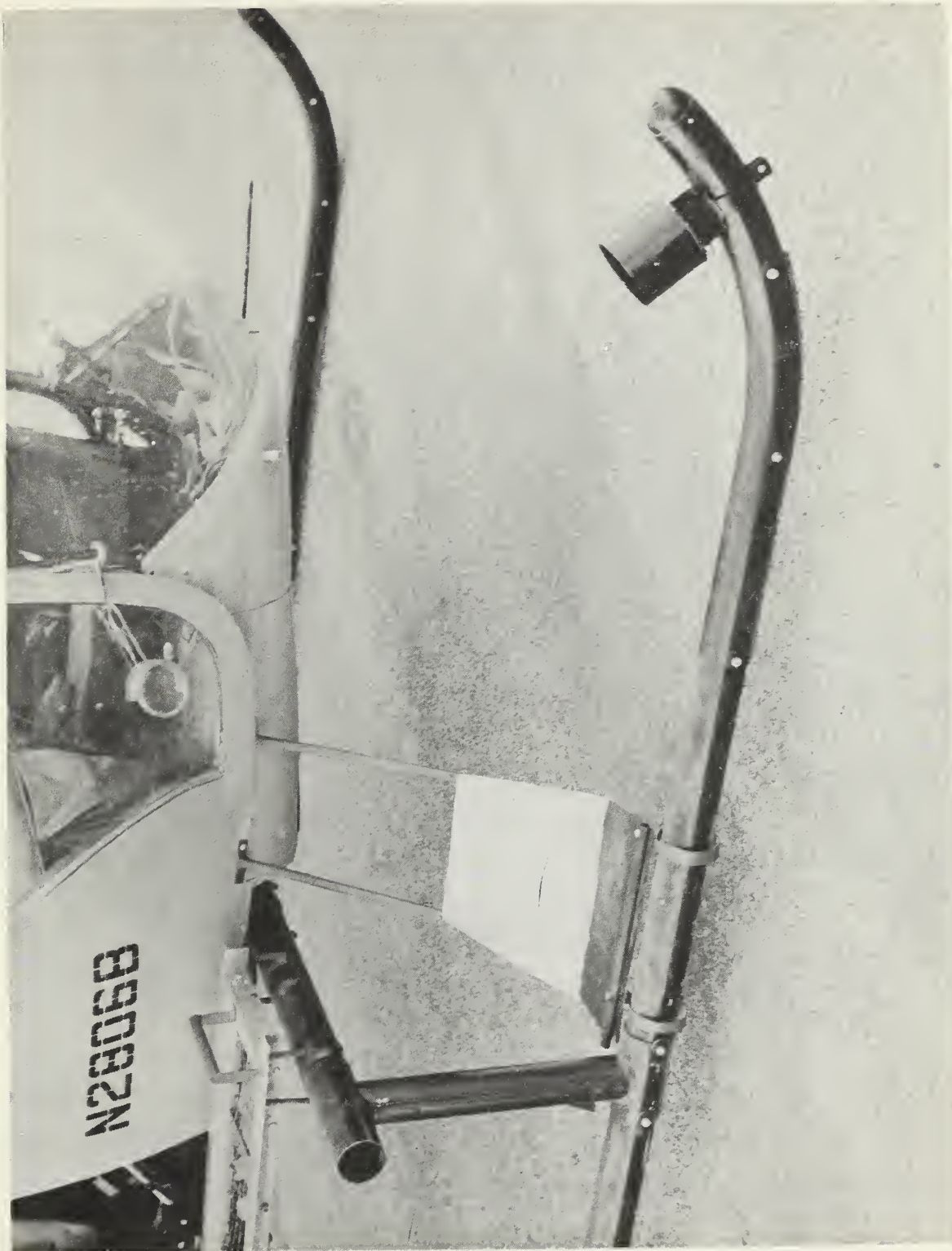
DATE: 11-3-58

DRAWING NUMBER

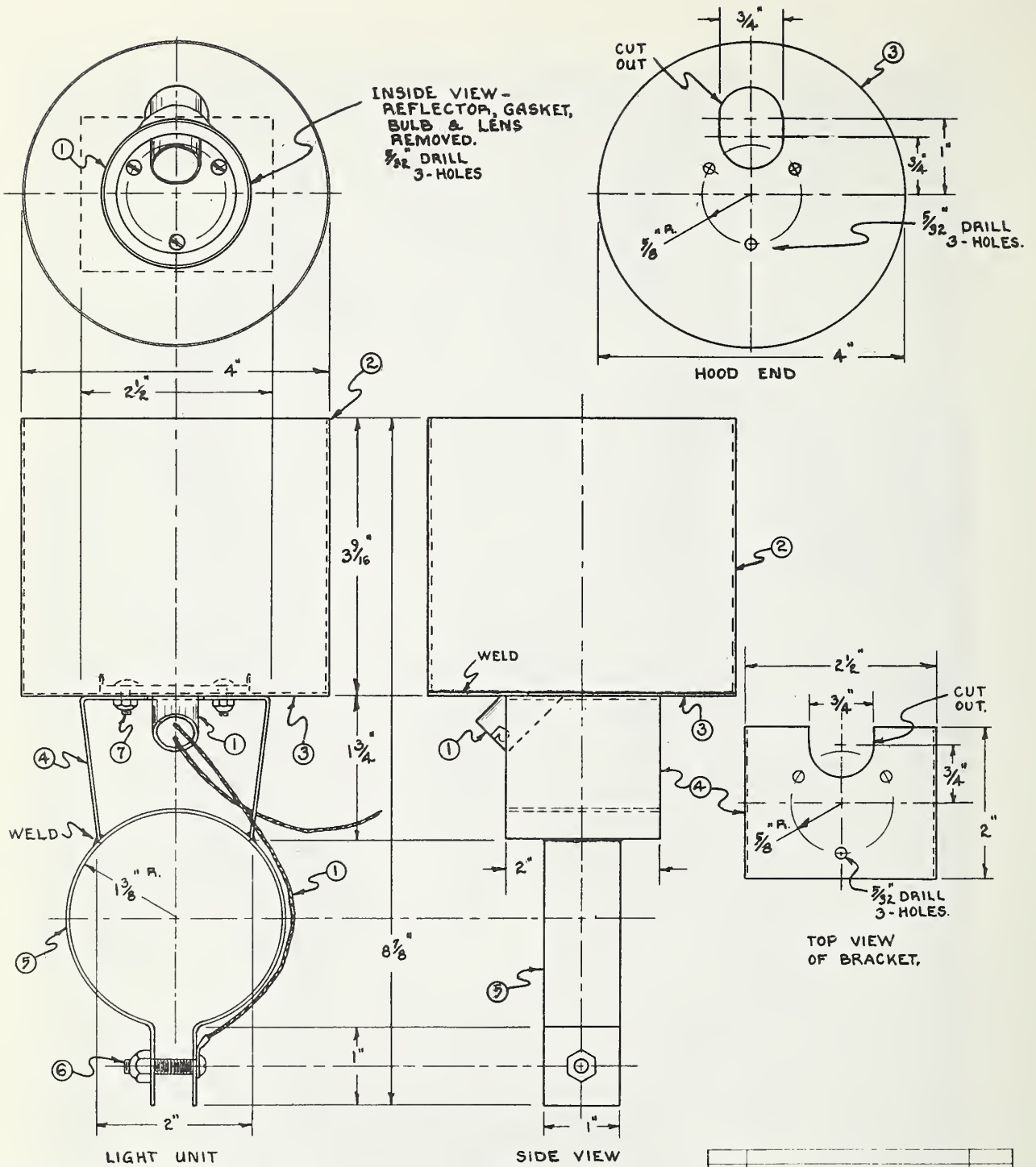
ED-160-RI

SHEET NO.

1 OF 1



SIGNAL WARNING LIGHT ON FRONT SECTION
OF HELICOPTER SKID - BELL 47G-2

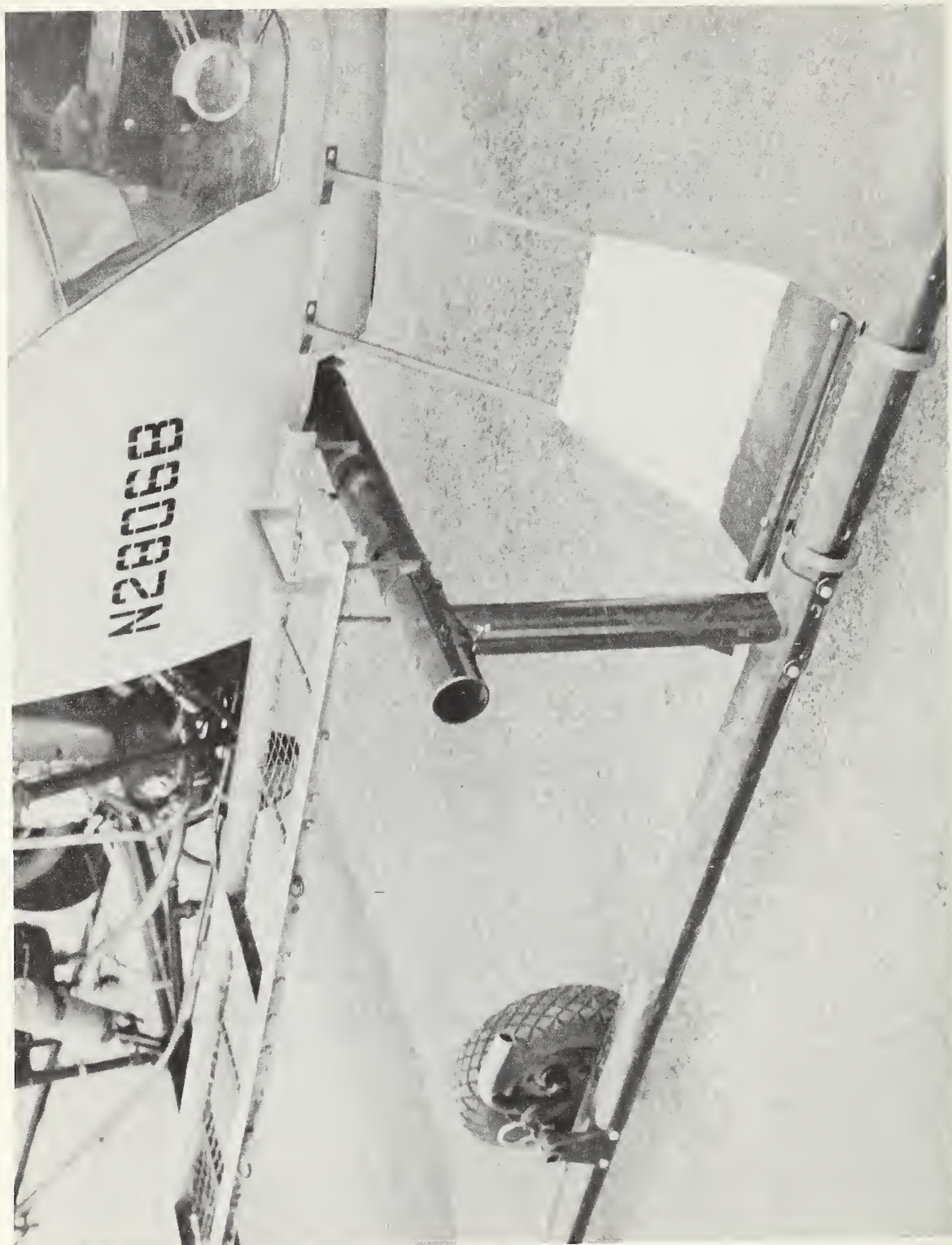


DATE	REVISION	BY
U. S. DEPARTMENT OF AGRICULTURE FOREST SERVICE		
MISSOULA EQUIPMENT DEVELOPMENT CENTER		
SIGNAL LIGHT FOR HELIHOPPERS		
DRAWN BY A. R. F.	DRAWING NUMBER	
CHECKED F. D. Bn	ED-196-R1	
APPROVED	SHEET NO 1 OF 1	
SCALE AS SHOWN	DATE 11-3-58	

SIGNAL LIGHT

Materials list for Drawing No. ED-156-R1

Name	Material	Part No.	No. Req.	Total Quantity	Color	Size	Spec. or No.	Type
Lamp unit, complete		1	1		Red lens		Model "C" position light, Stock No. B-1947, Lamp No. 308	
Hood, main	Aluminum	2	1	3 $\frac{1}{2}$ " x 12.566"	Painted black		24 ST	
Hood, end	Aluminum	3	1	4" x 4"	Painted black	4" dia.	24 ST	
Bracket	Steel	4	1	2" x 8-1/8"	Painted black		Aircraft	
Clamp	Spring steel	5	1	1" x 9"	Painted black		Aircraft	
Bolt, with fiberlock nut	Steel & fiber	6	1			3/16" x 3/4"	AN 3-12	
Bolts, with fiberlock nuts	Steel & fiber	7	3			1/8" x $\frac{1}{2}$ "	AN 6-32	
Disconnect splice unit	Metal	8	2				33030	
Connector shielding	Plastic tubing	9	2	12"		$\frac{1}{4}$ " x 6"		
Wire, electric		10	1	74"		14 Ga.		



SAFETY STEP FOR HELIJUMPING - BELL 47G-2

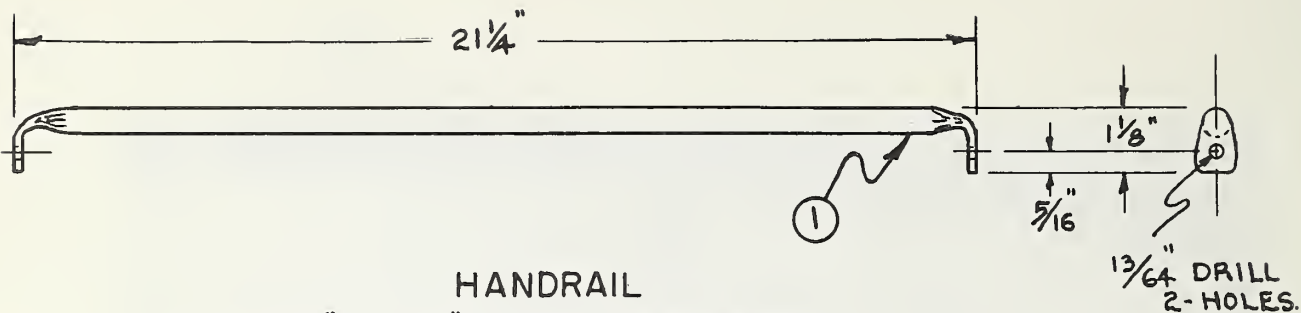
STEP

Materials list for Drawing No. ED-155-R1

Name	Material	Part No.	No. Req.	Total Quantity	Color	Size	Spec. or No.	Type
Frame, tubing	Steel	1	2	58"		5/8" x 29"	.035 41 30 steel	
Clamp	Spring steel	2	2	19"		3/4" x 9 $\frac{1}{2}$ "	.0625 thick	
Bolt with fiberlock nut	Steel and fiber	3	2				AN 3-24	
Step tubing	Steel	4	1			5/8" x 14 $\frac{1}{2}$ "	.035 41 30 steel	
Plate	Steel	5	2	6"		3/4" x 3"	.093 41 30 steel	
Step	Alclad aluminum	6	1			14 $\frac{1}{2}$ " x 15"	.051, QA 362	
Screw bolts with fiberlock nuts	Steel and fiber	7	2				AN 8-32	
Step tread paint		8					Paint-on wing walk, Aircraft material	



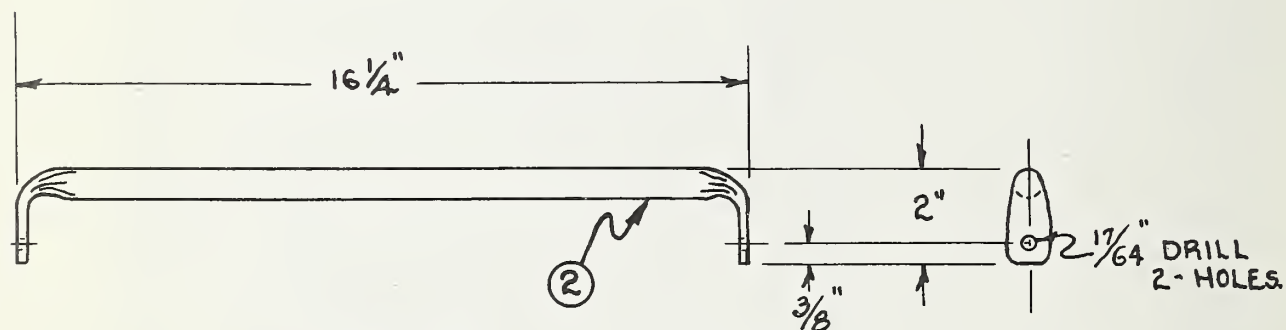
SAFETY HANDRAIL FOR HELIHOPPING - BELL 47G-2



HANDRAIL
 5/8" X 23 1/2" .035 4130 STEEL TUBING.
 2-EA. 3/16" X 5/8" AIRCRAFT BOLTS COMPLETE.

THIS HAND RAIL IS BOLTED PARALLEL BETWEEN
 UPPER DOOR HINGE BOLT TO INSTRUMENT
 PANEL FRAME.

R. H. SIDE.



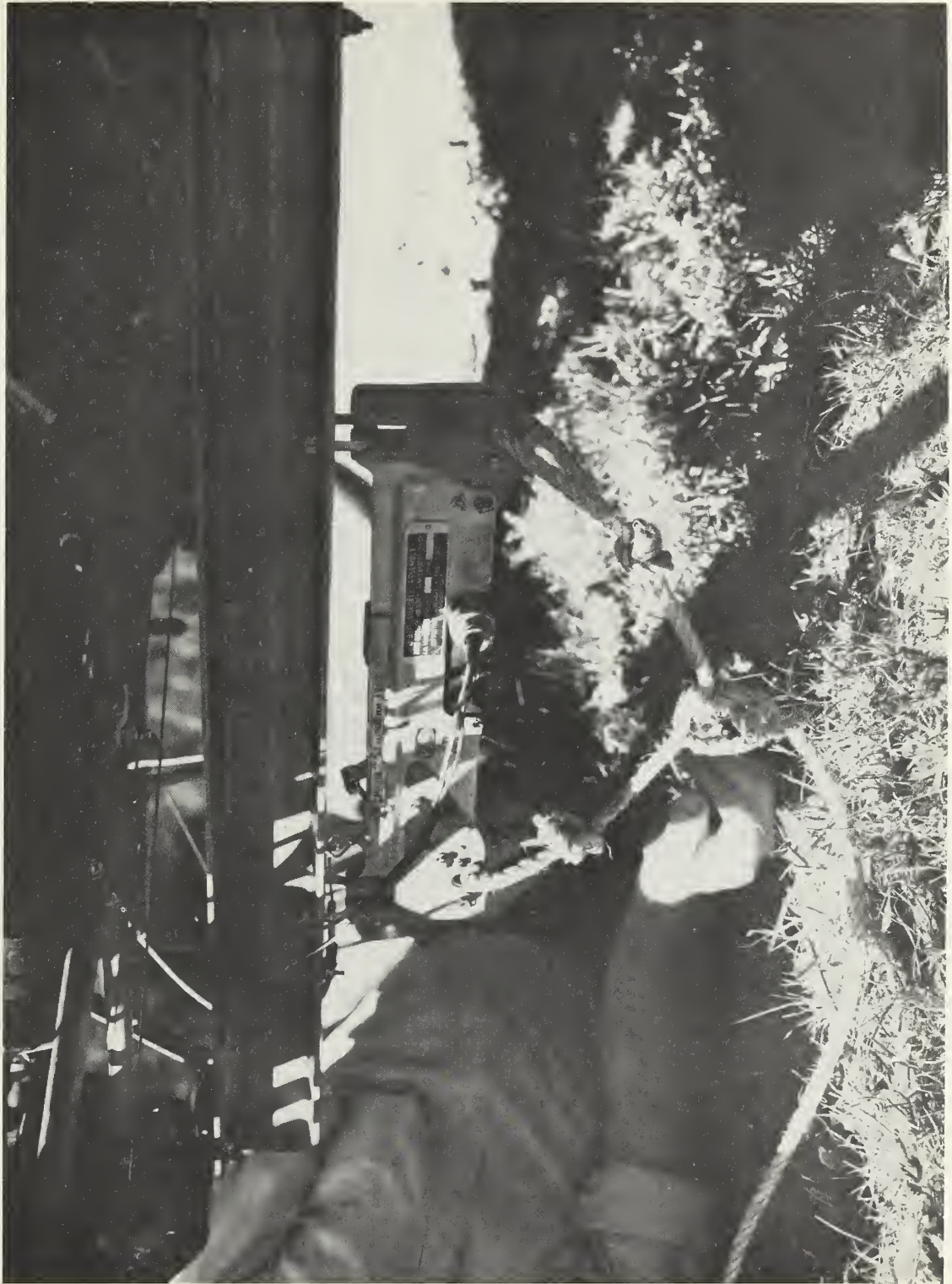
HANDRAIL

3/4" X 20 1/4" .035 4130 STEEL TUBING.
 2-EA. 1/4" X 3/4" AIRCRAFT BOLTS COMPLETE.

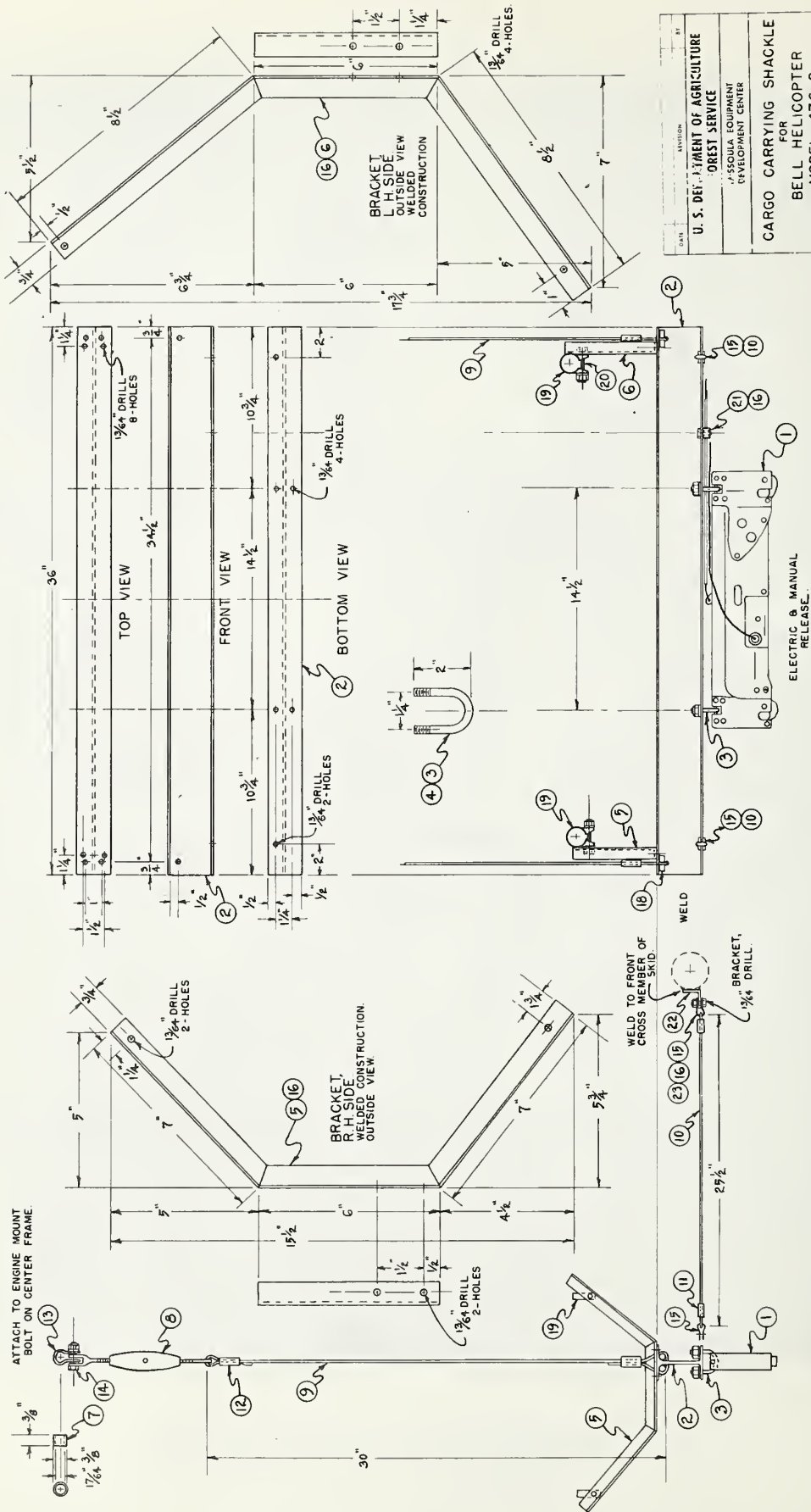
THIS HANDRAIL IS BOLTED TO
 MAIN ANGLES ON THE FRONT
 END OF CARGO RACK.

R. H. SIDE.

DATE	REVISION	BY
U. S. DEPARTMENT OF AGRICULTURE FOREST SERVICE		
MISSOULA EQUIPMENT DEVELOPMENT CENTER		
HANDRAILS FOR BELL HELICOPTER MODEL 47G-2		
DRAWN BY: A.R.F.	DRAWING NUMBER ED-163-R1	
CHECKED: W.C.W.		
APPROVED:		
SCALE: AS SPEC.		
DATE: 12-1-58.		
SHEET NO. 1 OF 1		



CARGO CARRYING SHACKLE AND SUPPORT BRACKET
BELL 47G-2



DATE	REVISION	BY
U. S. DEPT. OF AGRICULTURE FOREST SERVICE		
FOREST EQUIPMENT DEVELOPMENT CENTER		
CARGO CARRYING SHACKLE FOR BELL HELICOPTER MODEL 47G-2		
DRAWN BY A. R. F.	CHECKED BY J. P.	DESIGNED BY AS. SPEC.
DRAWING NUMBER ED-170-RI		
1-2-59		

R. H. SIDE

FRONT VIEW

ELECTRIC & MANUAL
RELEASE.

CARGO CARRYING SHACKLE

Materials list for Drawing No. ED-170-R1

Name	Material	Part no.	No. Req.	Total Quantity	Color	Size	Spec. or No.	Type
Shackle Assembly Complete	Metal	1	1				D-820	
"I" beam	Aluminum	2	1	36"		3"x2-1/4" x 1/4"	24 - ST	
"U" bolts	Steel	3	2	AS		1/4"	4130 steel	
Nuts, fiber-lock	Steel & Fiber	4	6	Specified				
Brace, R.H.	Steel angle	5	1	AS		1/4"	AN 365-428	
Brace, L.H.	Steel angle	6	1	Specified		3/4"x3/4" x 1/8"	4130 steel	
Sleeve, clevis	Steel	7	2	AS		7/64" I.D. 3/8" O.D.	4130 steel	
Turnbuckle	Steel	8	2	Specified			AN 140-32L	
Cable	Steel	9	2	70"		3/16" x 35"	Aircraft	
Cable	Steel	10	2	58"		1/8" x 29"	Aircraft	
Sleeves, micropress	Metal	11	4				AN 18-4-P	
Sleeves, micropress	Metal	12	4				AN 18-6-X	
Clevis	Steel	13	2				AN 115-32	
Bolt, clevis	Steel	14	2			1/4" x 1"	AN 4-2	
Clevis	Steel	15	4				AN 115-8	
Bolts	Steel	16	10			3/16"x5/8"	AN 4-52	

CARGO CARRYING SHACKLE

Materials list for Drawing No. ED-170-R1 (con't.)

Name	Material	Part No.	No. Req.	Total Quantity	Color	Size	Spec. or No.	Type
Nuts, fiberlock	Steel & fiber	17	14			3/16"	AN 365-1032	
Rod	Aluminum	18	2			3/8" D.x1"	24 ST	
Clamps	Metal	19	4			1"	AN 45 C20AA16	
Bolts, clamp	Steel	20	4			3/16"x1 $\frac{1}{2}$ "	AN 3-14	
Adel clamp	Metal & rubber	21	As Needed				AN 742-06C	
Bracket, angle	Steel	22	2			1 $\frac{1}{2}$ "x1 $\frac{1}{2}$ "x $\frac{1}{4}$ "x1"	4130 steel	
Washers	Steel	23	8				AN 960-416	



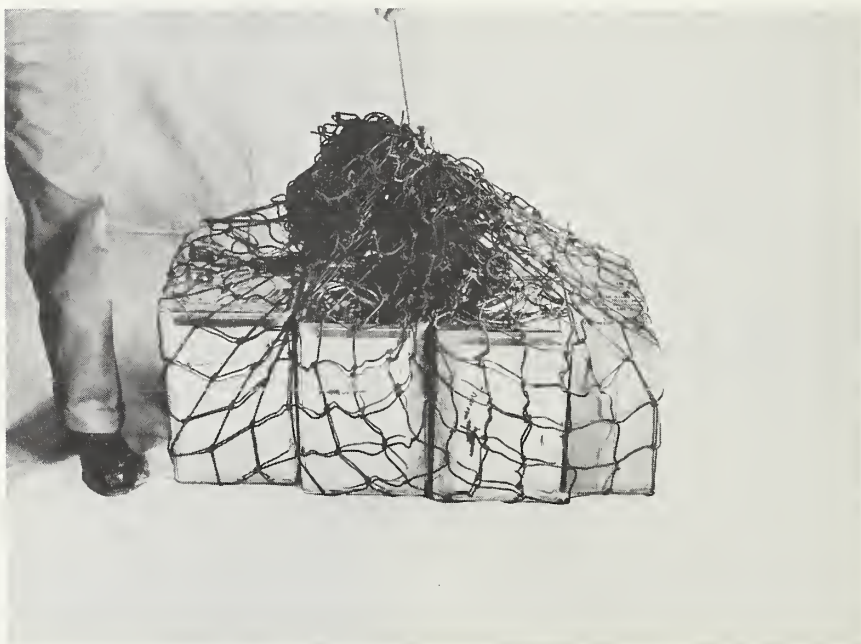
Helicopter takes off with load
attached to cargo sling
and shackle

Helicopter with cargo net and
loose cargo attached to sling





Dropping of cargo in net

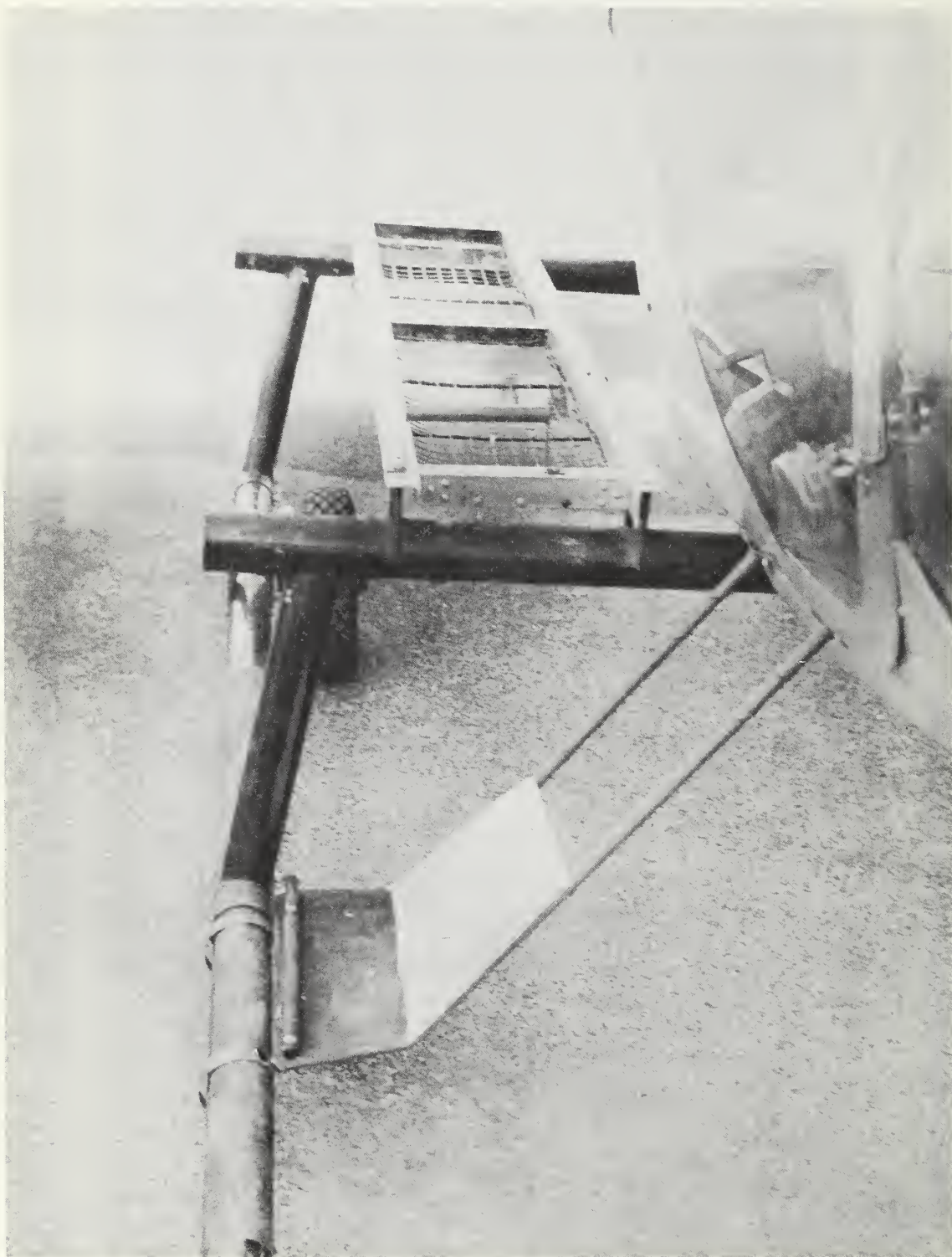


Cargo net constructed of nylon parachute cord. Net is 10' x 10' and is designed for 500-pound load when carried by helicopter, or 300-pound load when air-dropped with cargo parachute. Available through military surplus.

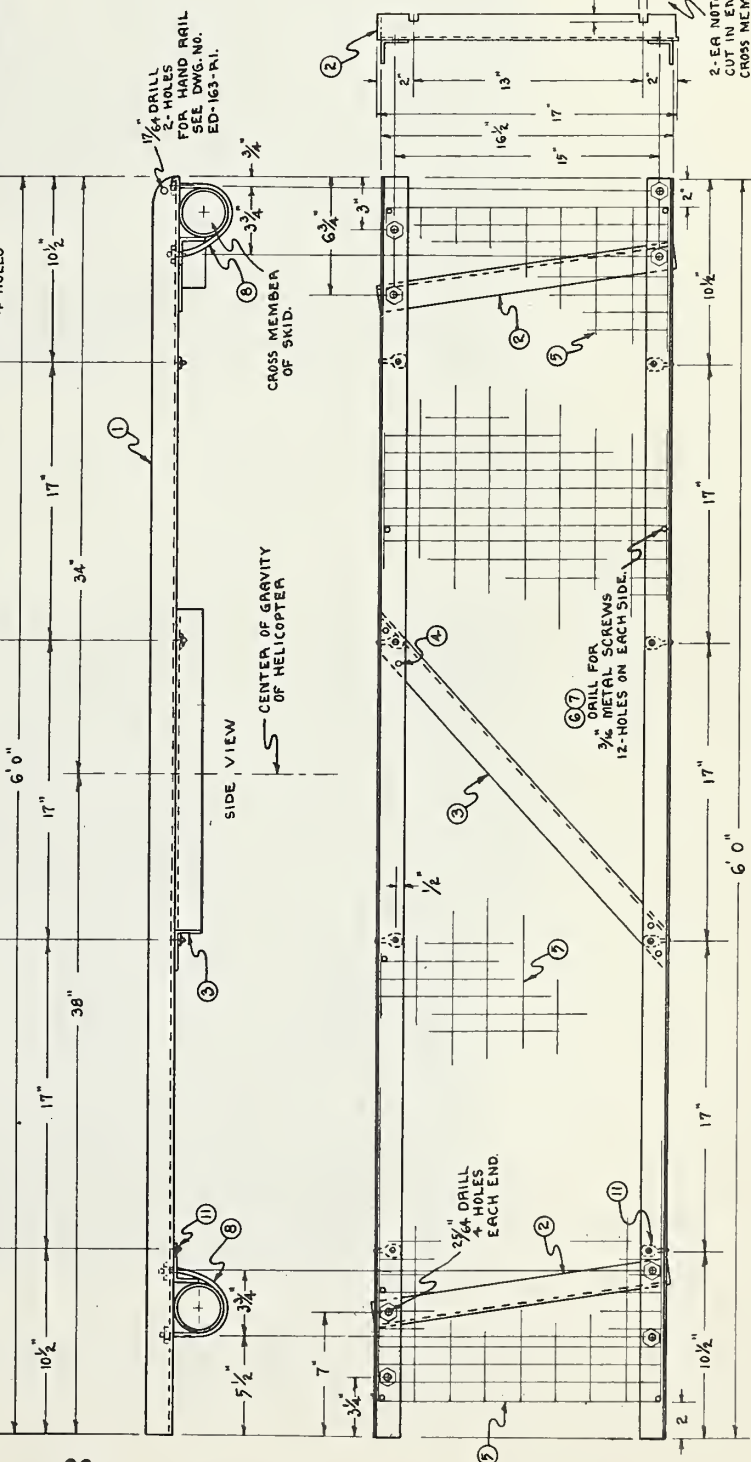


Delivery of Mechanical Equipment.

Note: Orange streamers are attached to trencher handles to increase visibility to ground crew as an additional safety precaution.



CARGO RACK ATTACHED TO SKIDS - BELL 47G-2



DATE	REVISION	BY
U. S. DEPARTMENT OF AGRICULTURE		
FOREST SERVICE		
MISSOULA EQUIPMENT CENTER		
CARGO RACKS FOR BELL HELICOPTER MODEL 47G-2		
DRAWN BY	CHECKED	DRAWING NUMBER
ARF	W.C.W.	ED-161-R1
APPROVED	SCALE	SHEET NO.
	AS SPEC.	109
DATE	INVOICE	

CARGO RACKS

Materials list for Drawing No. ED-161-R1

Name	Material	Part No.	No. Req.	Total Quantity	Color	Size	Spec. or No.	Type
Main frame	Angle aluminum	1	4	24' 0"		1 1/2" x 1 1/2" x 1/8" long	24-S.T.	
Cross members, end	Angle aluminum	2	4	5' 8"		1 1/2" x 1 1/2" x 1/8"	24-S.T.	
Cross members, center	Angle aluminum	3	2	4' 4"		1 1/2" x 1 1/2" x 1/8" long	24-S.T.	
Rivets	Aluminum	4	24			1/4" x 5/8"	24-S.T.	
Welded joint hardware cloth	No. 16 wire	5	2	33" x 68"		16" x 68"	1" x 2" welded joint	
Metal screws	Metal	6	48			3/16" x 1 1/2"	Aircraft	
Washers	Metal	7	48				AN 970-3	
"U" clamp	Steel	8	8			3/8" as specified	41 30 steel	
Washers	Steel	9	16			3/8"		
Nut, fiberlock	Steel & fiber	10	16			3/8"	Hex. head	
Tie hook	Steel	11	16			As Specified	41 30 steel	



Attaching cargo to cargo racks for resupply to lookouts



Helicopter at lookout administrative
helispot with cargo



BELL RANGER HELICOPTER MODEL J

SIGNAL LIGHT
SWITCH
ON REAR.

CARGO SHACKLE
RELEASE SWITCH
ON FRONT.

HAND RAIL
2-USED,
1 ON EACH SIDE.
SEE DWG. NO.
ED-157-RI.

SAFETY HARNESS ANCHOR
BRACKET IS LOCATED IN
THE REAR CENTER OF THE
CABIN, NEXT TO FIRE WALL
& IS ANCHORED ON THE FLOOR
& FIRE WALL. SEE DWG.
NOS. ED-154-RI & ED-162-RI.

BOTH DOORS
ARE REMOVED.

SIGNAL LIGHT,
2-USED,
ONE ON EACH
SIDE. SEE DWG.
NO. ED-156-RI.

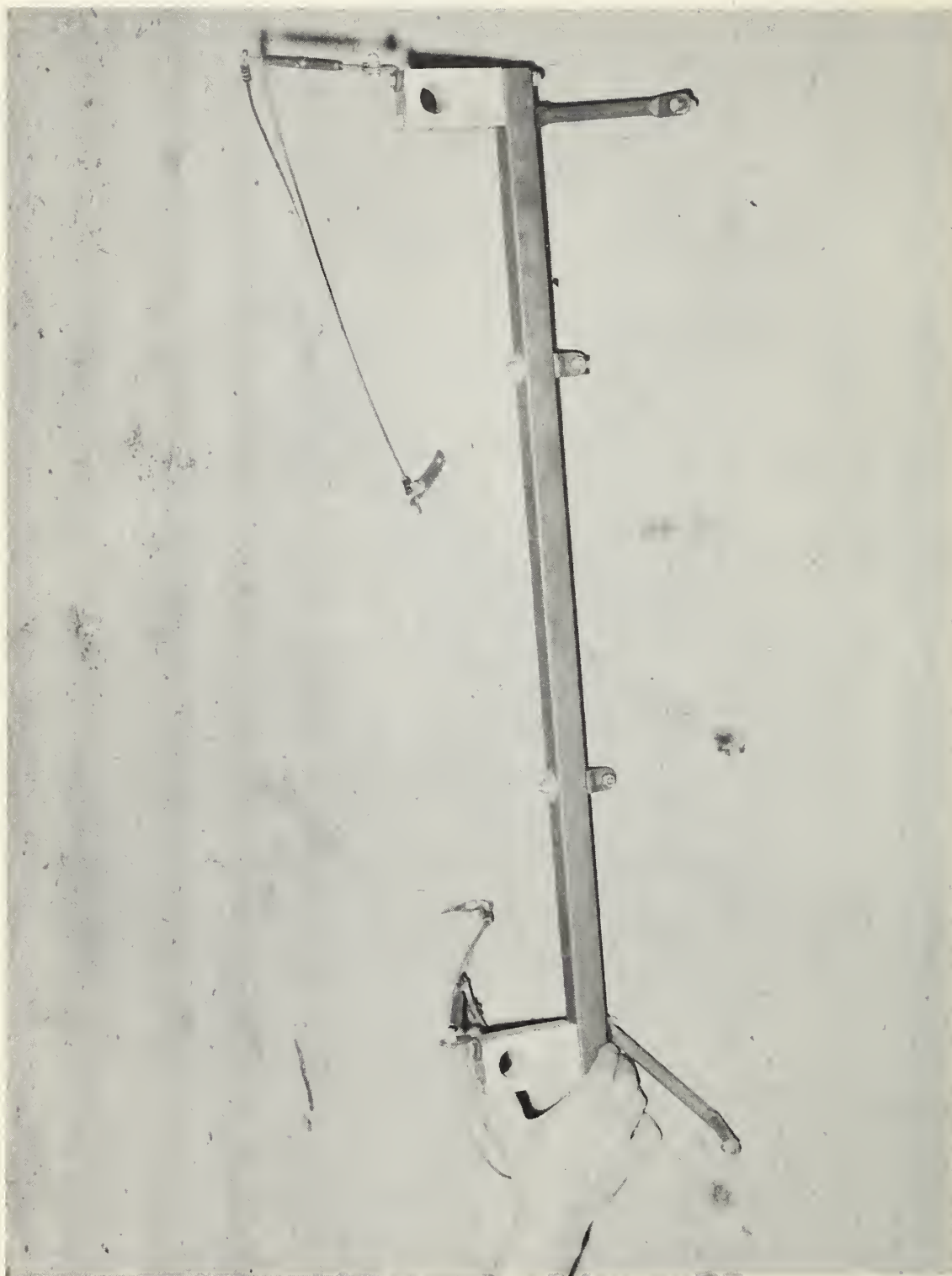
RADIO
ANTENNA.

18" EXTENSION
ADDED FOR TAIL
ROTOR PROTECTION.

CARGO CARRYING
SHACKLE. SEE DWG.
NO. ED-164-RI.

HAND RAIL
2 USED
SEE DWG. NO.
ED-158-RI

U. S. DEPARTMENT OF AGRICULTURE	
FOREST SERVICE	
MISSOULA EQUIPMENT DEVELOPMENT CENTER	
HELICOPTER ACCESSORIES FOR BELL HELICOPTER, RANGER MODEL "J"	
DRAWN BY: A. P. F.	DRAWING NUMBER
CHECKED: BEAUFORT	ED-159-RI
APPROVED: J. J. HARRIS	SHEET NO.
SCALE: None	1 OF 1
DATE: 11/10/59.	



BOMB SHACKLE SUPPORT BRACKET - BELL RANGER MODEL J

CARGO CARRYING SHACKLE

Materials list for Drawing ED-164-R1

Name	Material	Part No.	No. Req.	Total Quantity	Color	Size	Spec. or No.	Type
Shackle assembly complete	Metal	1	1				D-820	
Frame		2	1	35 $\frac{1}{4}$ "		1-1/8" x 1-1/8"	.049 41 30 steel	
Frame, filler	Wood	3	1	35 $\frac{1}{4}$ "		1" x 1"	Ash	
Shackle brackets	Steel	4	2			3/4" x 3 $\frac{1}{4}$ "	.125 41 30 steel	
Bolts, shackle bracket	Steel & fiber	5	2			$\frac{1}{4}$ " x 1-3/4"	AN 4-16	
Washers	Steel	6	12			$\frac{1}{4}$ "	AN 960-416	
Washers	Steel	7	2			$\frac{1}{4}$ " I.D. 1-1/8" O.D.	AN 970-4	
Bolt	Steel	8	6			$\frac{1}{4}$ " x 1"	AN 4-12	
Clevis	Steel	9	2			$\frac{1}{4}$ "	AN 115-32	
Brace	Steel	10	2	15"		$\frac{1}{2}$ " x 7 $\frac{1}{2}$ "	.049 tubing 41 30 steel	
Bolts	Steel	11	4			3/16" x 5/8"	AN 3-15	
Clamp, unit	Aluminum	12	2			1-1/8"x2"x 3 $\frac{1}{2}$ "	Parts A & B	
Bolts, clamp	Steel	13	2			$\frac{1}{4}$ " x 5"	AN 4-50	
Bolts, clamp	Steel	14	2			$\frac{1}{4}$ " x 5-1/8"	AN 4-51	
Nuts, fiberlock	Steel & fiber	15	12			$\frac{1}{4}$ "	AN 365-428	
Nuts, fiberlock	Steel & fiber	16	4			3/16"	AN 365-1032	
Sleeves, micropress		17	4				AN 18-4-P	
Turnbuckle	Steel	18	2				AN 130-46L	

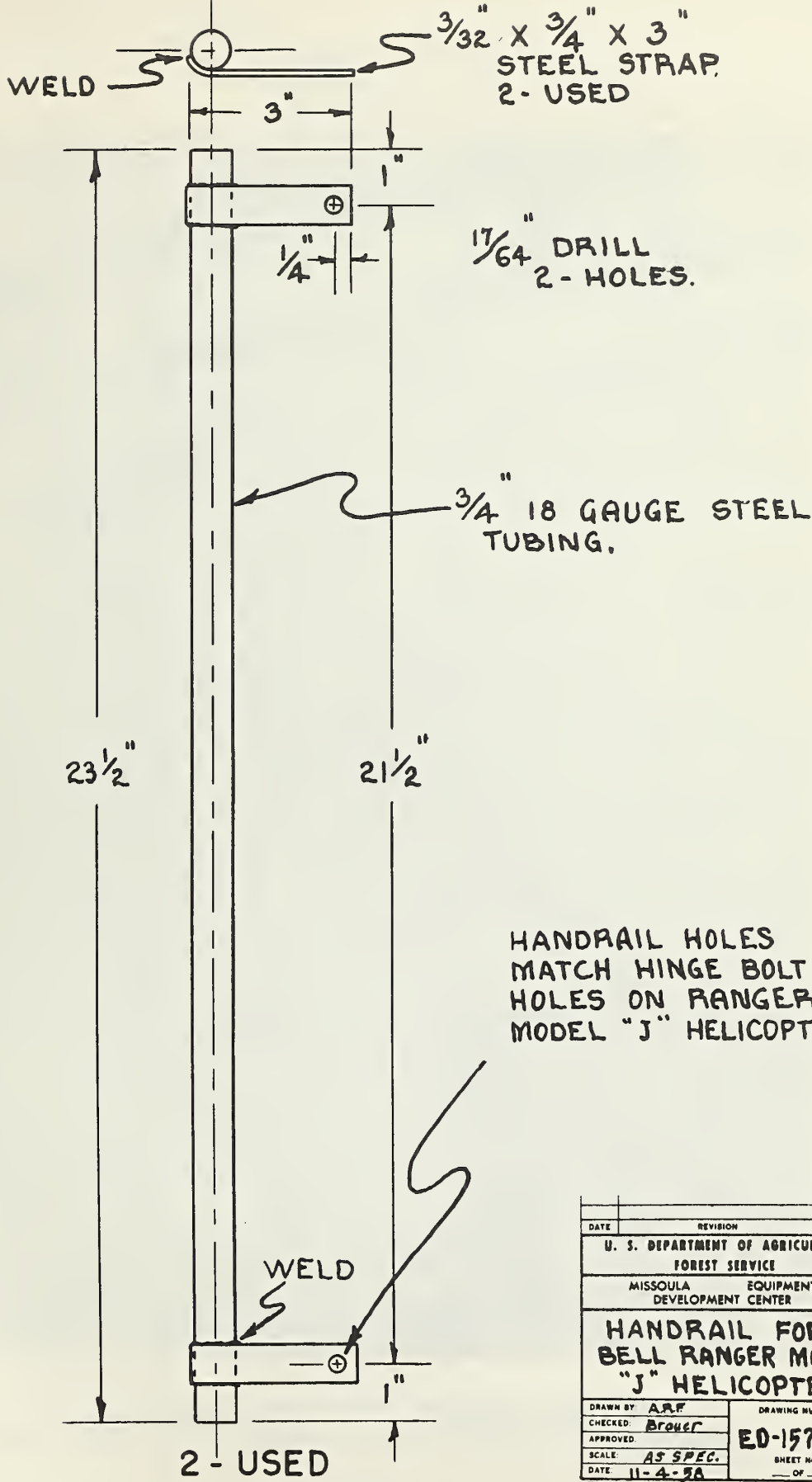
CARGO CARRYING SHACKLE

Materials list for Drawing ED-164-R1 (continued)

Name	Material	Part No.	No. Req.	Total Quantity	Color	Size	Spec. or No.	Type
Bracket	Steel	19	2			5/8" x 2"	.100 41 30 steel	
Bracket	Steel	20	2			5/8" x 2 1/4"	.100 41 30 steel	
Adel clamp	Metal & Rubber	21	As Needed				AN 742-06C	
Cable	Steel	22	2	54"		5/32" x 27"	Aircraft	



SAFETY HANDRAILS FOR HELITACK CREW MEMBERS -
BELL RANGER MODEL J



DATE	REVISION	BY
U. S. DEPARTMENT OF AGRICULTURE FOREST SERVICE		
MISSOULA DEVELOPMENT CENTER		EQUIPMENT DEVELOPMENT CENTER
HANDRAIL FOR BELL RANGER MODEL "J" HELICOPTER		
DRAWN BY: AAF		DRAWING NUMBER
CHECKED: Broder		ED-157-PI
APPROVED:		
SCALE: AS SPEC.	SHEET NO. OF	
DATE: 11-4-58		

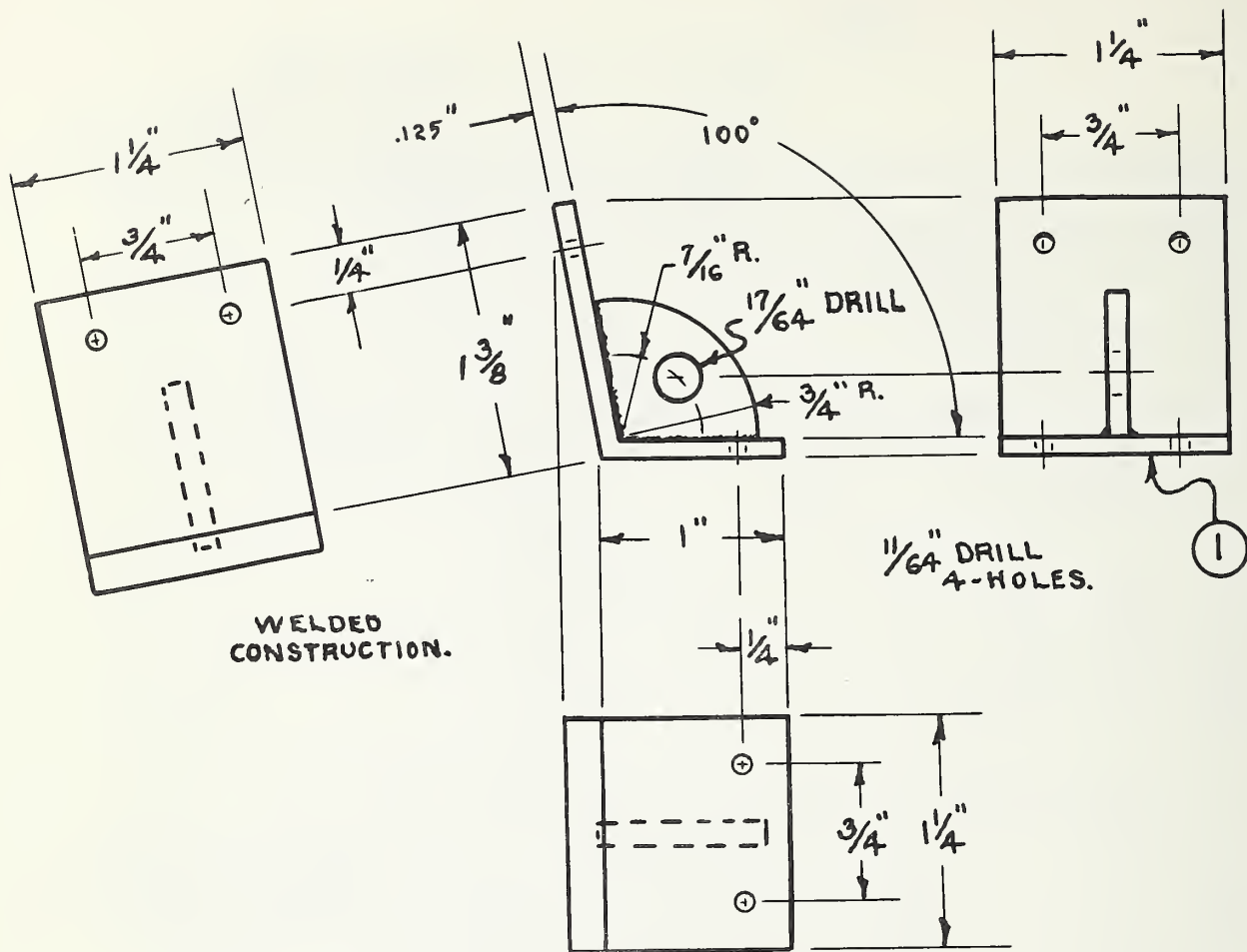


REAR SAFETY HANDRAIL FOR HELITACK CREW MEMBERS
AND SAFETY HARNESS ANCHOR IN CENTER OF SEAT - BELL RANGER MODEL J

UPPER END OF HANDRAIL IS
BOLTED TO SEAT HINGE BRACKET.
LOWER END IS BOLTED TO STRETCHER
SAFETY BELT BRACKET.

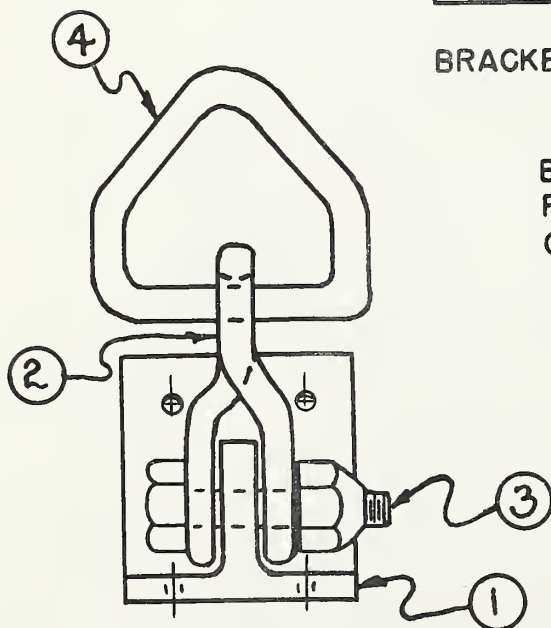


-34-



BRACKET DETAIL

BRACKET IS BOLTED TO FLOOR & FIRE WALL IN CENTER OF CABIN.



ASSEMBLY

DATE	REVISION	BY
U. S. DEPARTMENT OF AGRICULTURE FOREST SERVICE		
MISSOULA EQUIPMENT DEVELOPMENT CENTER		
SAFETY HARNESS ANCHOR FOR RANGER MODEL "J" HELICOPTER		
DRAWN BY: A.R.F.	DRAWING NUMBER	
CHECKED:	ED-162-R1	
APPROVED: J.P.	SHEET NO. 1 OF 1	
SCALE: AS SPEC.		
DATE: 12-1-58.		

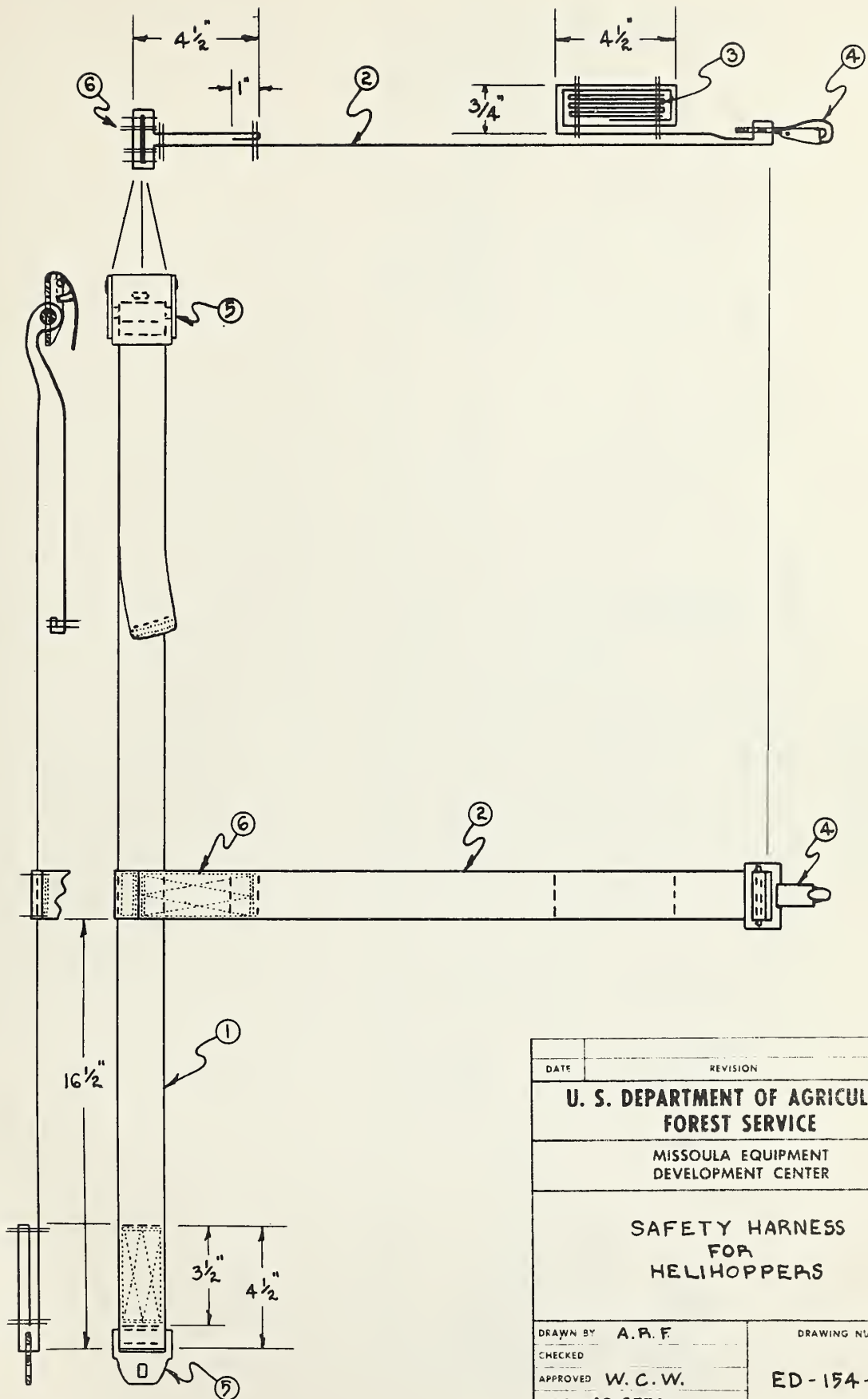
BRACKET

Materials list for Drawing No. ED-162-R1

Name	Material	Part No.	No. Req.	Total Quantity	Color	Size	Spec. or No.	Type
Bracket	Steel	1	1			As specified	41 30 steel	
Clevis	Steel	2	1				AN 115-32	
Bolt with fiberlock nut	Steel & fiber	3	1			$\frac{1}{4}$ " x 1"	AN 4-12	
"V" ring	Steel	4	1				USFS #44A9361	
Bolts with fiberlock nuts	Steel & fiber	5	4			5/32" x 1"	AN 8-32	



SAFETY HARNESS FOR HELITACK CREW



DATE	REVISION	BY
U. S. DEPARTMENT OF AGRICULTURE FOREST SERVICE		
MISSOULA EQUIPMENT DEVELOPMENT CENTER		
SAFETY HARNESS FOR HELIHOPPERS		
DRAWN BY	A. R. F.	
CHECKED		
APPROVED	W. C. W.	
SCALE	AS SPEC.	
DATE	10-1-58.	
DRAWING NUMBER		
ED-154-R1		
SHEET NO		
1 OF 1		

SAFETY HARNESS

Materials list for Drawing No. ED-154-R1

Name	Material	Part no.	No. Req.	Total Quantity	Color	Size	Spec. or No.	Type
Belt webbing	Nylon cond. "J"	1	1	57"	Sage green	1-3/4"	MIL-W-4088B	XIII
Extension webbing	Nylon cond. "J"	2	1	59"	Sage green	1-3/4"	MIL-W-4088B	XIII
Filler webbing	Cotton	3	1	18"	Optional	1-3/4"	MIL-W-5665a	XII Cotton
Snap, quick fit	Metal	4	1		Cadmium	1-3/4"	AN 6509-1	Parachute harness
Buckle, quick release, metal to metal, complete	Metal	5	1-unit			1-3/4"	Over 3000 pounds breaking strength	Available from E. D. Bullard Co.
Thread	Nylon	6	1		O.D. 613	3-ply	MIL-T-7807 5-cord, left twist	Type I Class 2

